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Rotary Multiple Magnetron Sputter Source Feedthrough

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Rotary Multiple Magnetron Sputter Source Feedthrough*

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Introduction

A vacuum compatible feedthrough was designed to provide power and water cooling to rotating multiple magnetron sputter sources. For many applications we have found that rotating the sources was the most practical means of achieving the desired distribution of deposited material. Several of these feedthroughs have been installed on sputtering systems in the Vacuum Processes Lab (VPL) of the Lawrence Livermore National Laboratory. Feedthroughs of this design have proven to be capable of providing independent electrical control, in addition to stable power and water cooling, for up to four rotating sources.

Description

The section of the feedthrough which is external to the vacuum chamber is about three feet long. Power leads are connected to finger stock, (see Figure 1) which contact the rotating slip rings. Each of these are in contact with a stainless steel water line, which is used to conduct the power to each source (in addition to providing cooling water). The length of the internal section may be varied to adjust the source-to-chamber-wall distance. A hollow custom-made Ferrofluidic feedthrough (Ferrofluidics Corporation, P/N 54A112071, with an 8" Conflat mounting flange and 3' rotating tube center) was used as the primary separation between vacuum and atmosphere. Ceramic breaks and

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stainless steel bellows were used to electrically isolate the water return lines.

Operation

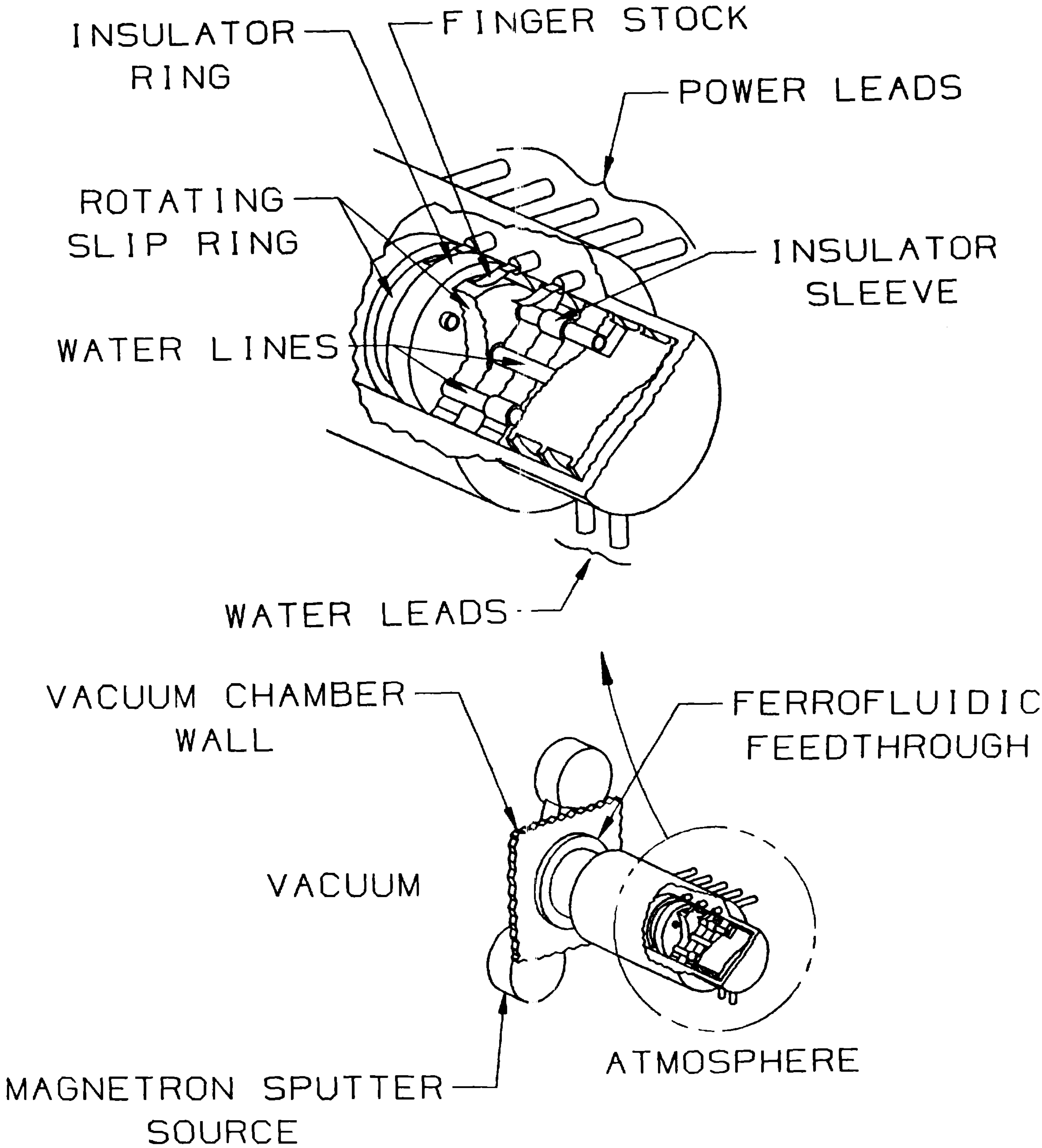
These feedthroughs have been operated at 10 kw (1 kv maximum, 14 amps maximum) with good results. The feedthrough has reliably provided 1 kw to each of two sources for 18 hours continuously. In order to check for adverse effects from the rotating electrical contacts, we measured the power at the sources both with and without rotation. We determined that the fluctuations in current and power were less than .3%, and this had no apparent adverse affect on the deposition rates. Cooling is critical, and a cooling interlock should be installed prior to use. We have found a flow of 2-1/2 gallons of water per minute per source at ambient temperature to be ample. In order to maintain electrical isolation of the sources, low conductivity water must be used. With the feedthrough installed we are able to achieve a chamber working pressure of $2X10^{-7}$ Torr. Typical process pressure during sputtering is 5 to 10 microns. We found that the feedthrough had minimal impact on either the system base pressure or pressure during operation.

Conclusion

The ability to provide high voltage power and water cooling to multiple rotating sputter sources, while maintaining vacuum integrity has proven to be a useful tool in our magnetron sputtering systems. We would like to acknowledge the work of Tom Beat and Roland Reiss in the design and testing of the feedthroughs.

Caption:

FIG. 1. The end of the feedthrough is shown, displaying a cutaway view of water lines and power distribution.



INSULATOR
RING
FINGER STOCK
POWER LEADS
ROTATING
SLIP RING
INSULATOR
SLEEVE
WATER LINES
WATER LEADS
VACUUM CHAMBER
WALL
FERROFLUIDIC
FEEDTHROUGH
VACUUM
ATMOSPHERE
MAGNETRON SPUTTER
SOURCE